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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:
B29C 73/34, B63B 9/00	A1	WO 94/11181
		(43) International Publication Date: 26 May 1994 (26.05.94)

(21) International Application Number: PCT/SE93/00951

(22) International Filing Date: 9 November 1993 (09.11.93)

(30) Priority data:
9203358-8 10 November 1992 (10.11.92) SE

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(81) Designated States: AU, BB, BG, BR, BY, CA, CZ, FI, HU, JP, KP, KR, KZ, LK, MG, MN, MW, NO, NZ, PL, RO, RU, SD, SK, UA, US, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
In English translation (filed in Swedish).

(54) Title: A METHOD OF TREATING LAMINATED OBJECTS OF PLASTICS

(57) Abstract

A method of treating laminated objects of plastics that have been damaged by osmosis or the like and which contain liquids and/or gases within laminate layers. Particularly within the damaged area the object is given such a temperature by controlled heating, that liquids are evaporated and gases are expanded in such a manner that covering layers are broken up and the damaged portion is exposed but also in such a manner that the damaged portion is not enduringly heated to a temperature exceeding 300 °C. Preferably the heating is combined with exertion of a mechanical force against the object in way to remove the material which has been loosened due to the heating.

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A method of treating laminated objects of plastics

The present invention relates to a method of curing preferably co called osmosis which may exist in practically all objects manufactured from plastics laminates. When osmosis is noted into such an extent that the objects are damaged this is normally referred to as that the objects have been hit by bubonic plague, plastics plague, glass fibre hull plague or osmosis. This latter term will be used hereinafter.

One type of objects that is frequently exposed to osmosis is plastics boats. Cfr for instance Båtnytt nr 10/1990 page 28 -31. Therefore, the description below will refer to the treatment of boats, although it is generally applicable.

It is not clear why osmosis does not occur always, or why a chemical acid generating process starts in some cases but not in other cases. However, it is clear that osmosis in many cases is a big problem.

It has been speculated about if the reason for osmosis is that there might be some constituents of the water that are active and that the bottom paint or dust that has contaminated the surface of the object during the manufacture functions as a catalyst.

The damages manifest themselves in that the acid, beyond forming gas blisters outwardly, also corrode inwardly. The size of the gas blister gives no sure indication on how big the damage is that is concealed within the hull. The extent of the damages will be evident only when these have been exposed.

In order to cure damages resulting from osmosis it is necessary

1. to localized all the damaged areas
2. to expose the damages
3. to remove both the formed acid and the damaged laminate material
4. to clean up and dry out
5. to build up the laminate to the original hull thickness and strength
6. to restore the hull on the outer surface by means of a water tight layer, such as gel coat or a migh molecular epoxy.

It is known that it is possible to use a drying equipment

of hyper absorption type, in the following referred to as hyab-equipment, for effectively drying laminate that has been made moist, such as at blasting or washing. Cfr. for instance Båtnytt nr 10/1990 page 29. In the article it is referred to drying by means of the hyab-equipment as "hyper drying by means of compressed air and bottle gas heat".

The hyab-equipments use compressed air and bottle gas in combination with each other and the drying medium consists of a dry, hot air flow that sweeps along the object at a high velocity.

The drying method of the hyab-equipments is based on the fact that the moisture is effectively removed from an object in that the surface thereof is cooled by the evaporation of the moisture and that the moisture within the material according to the "law of the cold wall" is urged to seek itself towards the surface thus cooled to be dried up there. Conversely, heat directed to the surface of an object urges the moisture deeper into the material. Cfr for instance HYAB-Comparison.

A visual localization of the damaged areas is not only time-consuming but may, indeed, be impossible to carry out, particularly if a hull has been standing on land for some time and has dried out, because the usually only mosquito-bite sized blisters have dried out and are no longer visible.

Despite this, particularly in hotter climates, a conventional method is to cure osmosis only when the hulls have been standing on land for an extended period in order to dry out. This timely extended method not only renders the localization of damages difficult but makes the whole curing of osmosis unnecessary expensive. Yards rental for storing the boat for an extended period of time, expenses for a continuous check of the moisture content of the hull and the fact that the boat is not available for its intended purpose are costs that may be reduced or eliminated entirely through the present invention.

The object of the present invention is to quickly and effectively localize and cure damages due to osmosis.

This object is achieved by means of the method a defined in claim 1.

The method encompassed by the present invention goes considerably further than only the already known drying technique which is utilized at first when the damaged areas have been localized and exposed.

By using, within the scope of the present invention, the temperature stability which characterizes the hyab-equipments, i.e. also by the higher temperatures that are not useful for drying, it is possible, without the harmful effects that may be the result of a heating by means of bottle gas burners only, to localized also damages in a hull that are concealed to the eye. Due to this it is possible to advantageously directly treat wet objects, such as "sea-wet" boats, which gives the method a considerable gain in time and thus savings.

This temperature stability may thus be utilized to not lastingly exceed the temperature up to 300° C which insurance companies now for risk of fire reasons prescribe for among other things hot jobs on roofs. Characterizing for the fire security at jobs with a hot compressed air jet is that, if an inflammable material should be put on fire, then extinguishing will be brought about by the air jet if it is quickly placed at a somewhat increased distance or is cooled by an immediate shut-off of the heat in that the air jet blows out the flame. When the heat admission is switched off entirely the air jet acts strongly cooling, which means that there, due to the invention, is always available an effective fire extinguishing and cooling medium at the job site.

One type of tool that may be used for the method according to the invention is, for instance, the HYAB-osmosis tools, which basically correspond to the known drying tools but which, among other things, are adapted for an immediate switching between heating and cooling function.

However, by the method according to the invention it is achieved not only that the damages are localized, but also that evaporated acid and gases build up a pressure, that from inside breaks up the superposed material.

The combination of controlled comparatively strong heat or cooling, respectively, with a mechanical action by the strong compressed air jet makes it possible clean the damaged area from both acid and damaged aliminate in one and the same

operation. The need for sand blasting methods, both wet and dry, which due to environmental considerations are not possible to use within all yard areas, are eliminated through the invention.

Considerable savings are, beyond the time gain wih respect to the treatment course, that the costs for blasting material and the removal thereof are eliminated, and that the hull must not be covered.

Other disadvantages of the present blasting methods are that they are effective but simultaneously coarse methods which, due to the difficulties to visually determine the existence of damages, "to be sure" are often utilized for the whole hull rather than limiting the destroying action of the blasting to only the damaged areas. Thus, by sand blasting, where it can be utilized at all, it should be noted that it is oftentimes too efficient and, by its destroying action, may result in damages and considerable unnecessary excessive work with a.o. application of several replacing layers of glass fibre reinforcement in order to restore the original thickness and strength of the hull.

A general drawback inherent with all blasting is that the laminate becomes uneven and has to be built up anew in order to reach its original strength and moothness. Due to the coarse operation of the blasting this rebuilding to original smoothness becomes time- and material consuming which results in unnecessary high costs.

By hull treatment within the scope of the invention the efforts may, as already mentioned, be concentrated to the localized areas where damages are to be found. Between the cured areas there are left intact and untouched areas that denote the original shape of the hull, prior to the curing. With these intact areas as templates the restoring job is easier and the material consumption will be less.

In the following one embodiment of the method according to the invention is described with reference to three figures, where

fig. 1 illustrates how a typical osmosis damage looks four years after a damage has been initiated, and illustrates a cross-section of a boat hull 1, which is built up from the

following layers, as seen from the outer surface: gelcoat 2, fibreglass reinforced polyester 3, a surface layer 4. The damaged portion 5 contains e.g. water, acid and gases.

fig. 2 illustrates a damaged portion 5 that has been cleaned up and prepared for restoring and that comprises remaining useful glass fibre reinforcement 6,

fig. 3 illustrates the final result where the damaged portion has been repaired with penetrating epoxi 7, which is covered by a water resistent layer such as high molecular epoxi paint 8 and filling of irregularities, conventiently epoxi putty 9.

The treatment according to the invention is uncomplicated and is divided into two main steps - cleaning incl. washing and drying, resp. restoring.

The only thing that is required to guarantee a lasting quality of the treatment is an absolute fullfilment of the three main requisites of the method is:

1. acid and contaminations should be removed entirely
2. the hull should be dried down to moisture content lower than 20% relative humidity
3. the protection against moisture penetration should be restored and peferably improved.

CLEANING

The first step of this phase is to localize the damages, which may prove difficult in that the hull may be outwardly intact without outer signs which indicate an underlying osmosis-damage.

The econd step is to expose a solid, fresh bottom from which the restoration may start up. Special, handheld tools, HYAB-Osmosis-tools, for compessed air and bottled gas are available for this purpose.

What the osmosis-tools, supplemented by the mechanical force of the hot compressed air jet, in fact bring about in practise is, with carefully controlled heating, to create such a temperature that liquids existing within the hull are evaporated and gases are expanded in such a manner that overlying layers are broken up and the damaged area is exposed, and in

the same course, damaged freed material is blown away. To avoid heat damages, this must take place while observing that the damaged area is not lastingly heated to a temperature exceeding 300° C.

By means of the osmosis-tools a localizing and exposing of the damaged areas is achieved in one and the same operational step, and this only where there exits a damage, visible or not. The tools are balanced in such a way that, when their action is applied to fresh hull portions, will possibly existing apint layers be affected, but both gelcoat and laminate remain unaffected.

All types of HYAB-tools are characterized by their gentle operation. As distinguished from sand blasting, dry or wet, the tools will remove only damaged material on exposing of a damaged area. Existing fibre glass reinforcment remains intact for re-use together with the material that is utilized for rebuilding the hull into its original dimension.

Cured damaged areas become next to stronger after a ompleted treatment.

The third step is a quick cooling of the exposed damaged area. Thereby it is also achieved that possible residual underlying acid and moisture move towards the surface and may be taken care of there. Thereby, the tools use only the constant compressed air jet with a heating effect which is quickly adjustable according to the requirements. The compressed air that passes through the nozzle of the tool when the LP-gas has been shut off attains an improved cooling effect by its expansion.

The fourth step is to get a confirmation that all acid and all other contaminants have been removed. This is easily performed by a repeated treatment of the surface while alternatingly heating and cooling until all residual acid has reached the surface and has been removed. As the acid is green or black it is very easy to determine when the cleaning has been completed - which is the case when no more green or back substance can be seen.

The above method, carried out in a continuous operation on a few square inches each time ensures control of the working temperature and gives also guarantee that each portion of the

CLAIMS

1. A method of treating laminated objects or plastics which have been damaged for instance by osmosis or the like and thus contains liquids and/or gases in laminate layers, c h a r a c t e r i z e d in that the object, preferably in the damaged area, by a controlled heating is given such a temperature that liquids are evaporated and gases are expanded in such a manner that overlying layers are broken up and the damaged area is exposed but such that the damaged area is not lastingly heated to a temperature exceeeding 300° C.

2. A method as claimed in claim 1, c h a r a c t e r i z e d in that the heating is combinded with a mechanical force by which the object is subjected to such an effect that the material that has been freed through the heating is removed.

3. A method as claimed in claim 1 or 2, c h a r a c t e r i z e d by a quick cooling of the exposed damaged area by e.g. compressed air that has been chilled by expansion.

4. A method as claimed in one of claims 1 - 3, c h a r a c t e r i z e d i n that the damaged area is alternatingly heated and cooled until all acid and other contaminants within the material have been removed.

5. A method as claimed in one of claims 1 - 4, c h a r a c t e r i z e d i n that a concentrated compressed air jet, generated e.g. in a nozzle at a pressure of 4 bar or higher, is blown towards the surface in such a manner that a strongest possible mechanical action is brought about within the damaged area under such a control that the area under control is given the desired temperature for heating or cooling, respectively.

6. A method as claimed in one of claims 1 - 5, c h a r a c t e r i z e d i n that the object is high pressure cleaned and dried, preferably by means of a drying equipment of the hyperabsorption type to a moisture content not exceeding 20% relative humidity.

7. A method as claimed in one of claims 1 - 6, c h a r a c t e r i z e d by the following steps:

1. localizing of a damaged area
2. exposing of the damaged area
3. cleaning of the damaged area
4. washing of the object
5. drying of the object

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Fig. 1

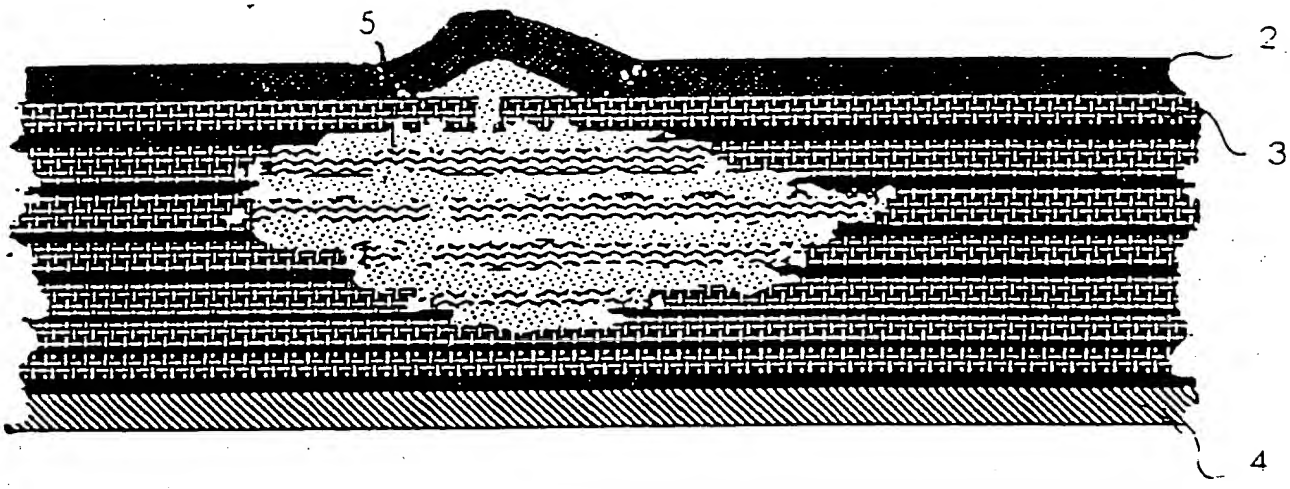


Fig. 2

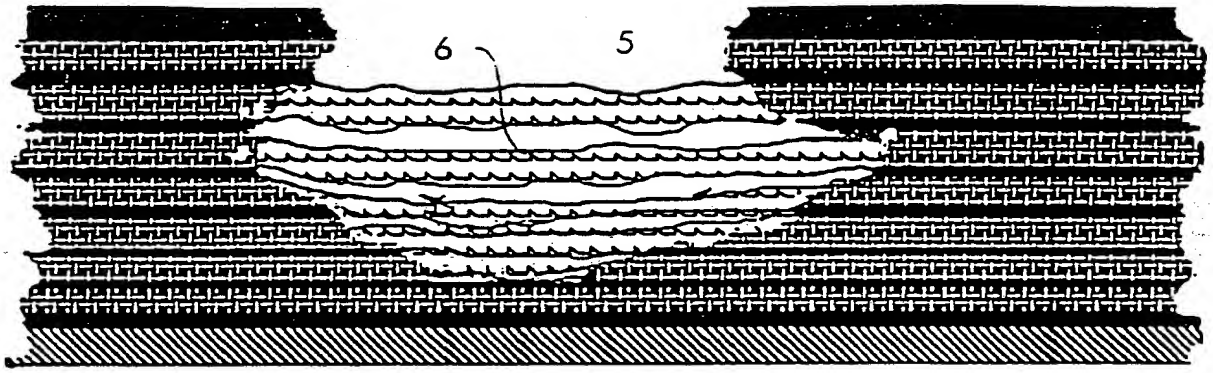
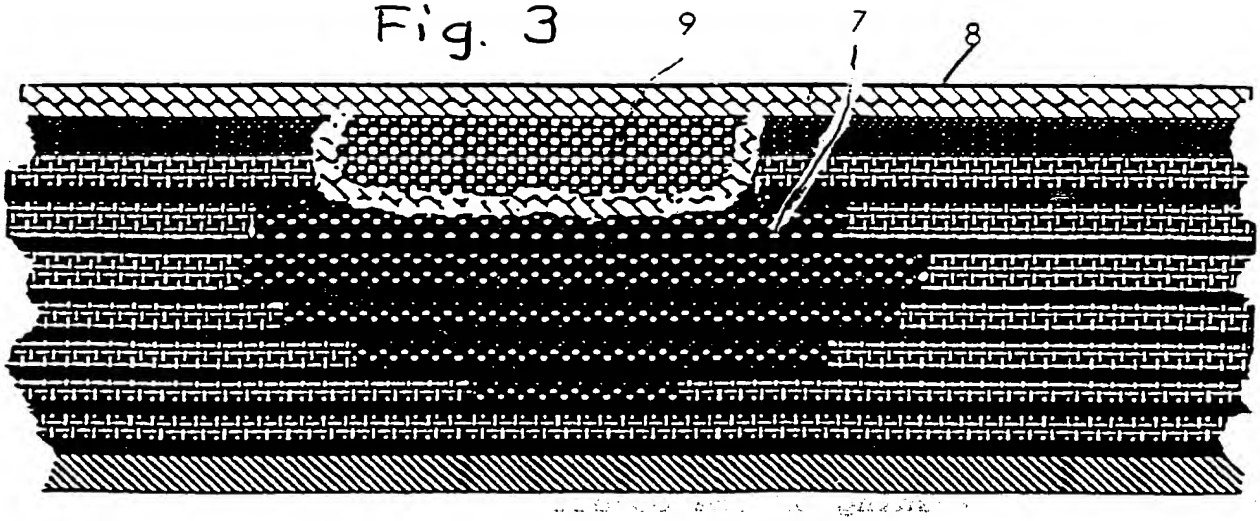


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 93/00951

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: B29C 73/34, B63B 9/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: B29C, B63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Båtnytt, Volume, No 10, Sept 1990, Curt Gelin , "Drabbad av pesten, ingen fara - den går att bota" -- --------	1-7

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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